PROMOTING ADOLESCENT IMMUNIZATION

NEW VACCINES AND VACCINE RECOMMENDATIONS for adolescents have recently occurred and more are likely to occur within the next few years. Experience with adolescent vaccine delivery is limited, and developing a system to deliver and finance vaccines to this population is becoming increasingly important.

PRIOR TO 2005, THE ONLY VACCINE ROUTINELY RECOMMENDED for adolescents was the tetanus and diphtheria toxoids (Td) booster. Three other vaccines, hepatitis B, measles-mumps-rubella, and varicella, were indicated as "catch-up" vaccinations for adolescents who were not up to date or, in the case of varicella, lacked vaccination and had negative history of disease.

LICENSURE OF NEW ADOLESCENT VACCINES

IN 2005, THE FDA LICENSED NEW VACCINES to prevent *Neisseria meningitidis* and *Bordetella pertussis*, and the Advisory Committee on Immunization Practices (ACIP) recommended them for routine use in adolescents. The first of the new vaccines was a quadrivalent conjugate vaccine (MCV4) for the prevention of invasive meningococcal disease caused by *N. meningitidis* serogroups A, C, Y and W-135. Next came two tetanus toxoid, reduced diphtheria toxoid and acellular pertussis vaccine (Tdap) products . Tdap is indicated for booster immunization against tetanus, diphtheria and pertussis. ACIP recommendations for these vaccines have been published in the CDC's *Morbidity and Mortality Weekly Report* (available at *www.cdc.gov/nip/publications/acip-list.htm)*.

MENINGOCOCCAL DISEASE

Over the past few decades, the incidence of invasive meningococcal disease in the United States has ranged from 0.5 to 1.7 cases per 100,000 population (1,400–2,800 cases). The death rate has remained between 10% and 14%; 11% to 19% of survivors suffer serious sequelae, including deafness, neurologic deficit or limb loss. Disease is seasonal, with cases peaking in December and January. Incidence is highest among infants younger than 1 year (9 per 100,000—16% of the total cases). Incidence increases during adolescence, peaking at 2 per 100,000 among 18 year olds. For reasons that are not completely understood, college freshmen living in dormitories also have an increased risk of infection. Transmission occurs when close, face-to-face contact permits the exchange of salivary secretions from people who are ill or carriers. Adolescents and young adults have the highest carriage rates, but few develop disease. However, every case triggers a costly public health response. Due to the effectiveness of antibiotic prophylaxis following confirmed cases, most cases (97%) are sporadic and only a minority (3%) is associated with outbreaks.

MCV4

Worldwide, five serogroups of the bacterium—A, B, C, Y and W-135—cause most disease. In the United States, serogroups B, C and Y cause almost all cases. Two vaccines are available in the United States, the older meningococcal polysaccharide vaccine and the new meningococcal conjugate vaccine, MCV4. Both protect against the A, C, Y and W-135 serogroups but not serogroup B. MCV is created with an antigen that alone induces a suboptimal antibody response (the polysaccharide coating of the bacterium). When bound to a stronger antigen (diphtheria protein), the combination, or conjugate, causes the immune system to recognize the polysaccharides and develop antibodies. Meningococcal conjugate vaccine is therefore expected (but not proven) to have a longer duration of immunity.

PERTUSSIS

Following the introduction of routine childhood immunization against pertussis in the 1940s, the number of reported pertussis cases declined dramatically, reaching an historic low of 1,010 in 1976. Since then, the number of reported cases has been steadily increasing, especially among adolescents and adults. Possible reasons for the increase in reported pertussis cases include a true increase in the burden of disease and an increase in the detection and reporting of cases. Massachusetts has an especially good surveillance system for pertussis and uses an in-state, standardized serology test to confirm cases. During 1996–2004, the average annual incidence of pertussis reported in Massachusetts adolescents aged 11–18 years was 93 per 100,000 population. Adolescents with pertussis commonly experience a prolonged cough and sometimes have complications. In most years, no pertussis-related deaths are reported among adolescents, although they can occur.

Tdap

The pertussis antigen composition of Tdap is similar to pediatric diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP) that is administered to infants and young children, but some pertussis antigens are reduced in quantity. The tetanus and diphtheria toxoid composition of Tdap is similar to adult tetanus and diphtheria toxoids vaccine (Td). A single dose of Tdap is routinely recommended, instead of Td, for adolescents aged 11-18 years.

HEPATITIS B

The rate of hepatitis B disease in adolescents hovered around 10 cases per 100,000 in the 1980s. A marked decline in incidence of the disease in children and adolescents accompanied the introduction of universal vaccination of these age groups in the 1990s. The largest decline (72.5%) occurred among adolescents; the rate has now fallen to about one case per 100,000.

ADOLESCENT VACCINES IN DEVELOPMENT

BETWEEN 2006 AND 2015, NEW VACCINES that will likely be targeted for administration to adolescents may become available to prevent infections from **human papillomavirus** (HPV), **herpes simplex** (HSV), **cytomegalovirus** (CMV), **chlamydia** and **group B streptococci**.

HPV is the cause of cervical cancer, which kills approximately 4,000 women per year. At present, the two vaccine candidates for HPV in the final stages of clinical development are only effective before exposure to HPV. HSV type 2 causes lifelong infection and significant medical and psychosocial morbidity. A vaccine has the potential to reduce HSV acquisition, disease severity and the number of cases of neonatal herpes, and it may also reduce transmission of HIV.

CMV infection is the most common intrauterine infection in the United States, causing congenital infection in children. A CMV vaccine administered to adolescent females would decrease morbidity and mortality by reducing the disease burden of congenital CMV infection.

By 2015, it is possible that vaccines against HIV and tuberculosis will be introduced; at least some of these will have the greatest benefit if administered to adolescents.

NUMEROUS VACCINES, LIMITED TIMEFRAME

WHILE VACCINES FOR ADOLESCENTS come with a virtual guarantee of effectiveness, they do not come with the additional time required to educate patients about the importance of being vaccinated. The problem becomes even more challenging with how to integrate the new vaccines into the delivery of the many other clinical preventive services recommended for adolescents. Medical staff can do most of the legwork required to screen for and inform patients and parents about the vaccines and the diseases they prevent. Patients can be given information on the vaccines at the time that they check in for their visit. The vaccine manufacturers will provide targeted materials about the new vaccines, and federally developed Vaccine Information Statements (VISs) are available at *www.cdc.gov/nip/publications/VIS/default.htm*. Besides presenting noncommercial information on each vaccine, the VIS is also available in many languages.

A greater challenge is integrating immunization into the array of clinical preventive services recommended in **Guidelines for Adolescent Preventive Services (GAPS)** and **Bright Futures**. GAPS consists of 24 recommendations that encompass healthcare delivery, health guidance, screening and immunization. Even more comprehensive, the Bright Futures initiative is a national health promotion and illness prevention initiative launched in 1990 to promote the health and well-being of infants, children, adolescents, families and communities.

One of the greatest challenges for the public health community is how to provide comprehensive preventive services for all adolescents. While more than 90% of adolescents report having a usual source of care, only two-thirds report having made a preventive visit in the last year. With special training, the proportion of the

recommended preventive services that can be delivered during a visit can increase but "gaps" remain.

Another tremendous challenge is uninsured or under-insured children, high school dropouts and youth confined in juvenile residential facilities. Fortunately, the VFC program makes vaccines available at no charge to almost all such youth. Children are eligible for the VFC program if they are under age 19 and either:

- Medicaid eligible
- Uninsured
- Under-insured (with insurance that does not cover immunizations) and being seen in a federally qualified health center or rural health center, or
- American Indian/Alaskan Native

Administration of recommended vaccines to adolescents continues to offer the potential to protect the health of both the individual adolescent and the public.

ADOLESCENT STAKEHOLDERS MEETING

A TWO DAY ADOLESCENT STAKEHOLDERS MEETING, sponsored by CDC and the National Vaccine Advisory Committee (NVAC), was held in Washington in June 2005. The meeting included over 140 key stakeholders with an interest in adolescent immunization. The objectives for this meeting were to identify issues expected to arise with the licensing of new vaccines for this age group and identify approaches that will most effectively increase adolescent vaccination. A series of white papers summarizing findings from this meeting will be published in *Pediatrics*. The NIP website also offers an adolescent area entitled "Vaccines for Teens: Vaccinate before You Graduate," available at *www.cdc.gov/nip/recs/teen-schedule.htm*. The site includes information about vaccines recommended for teenagers and provides links to information about vaccines for adults and children.